



1500 Eckington Place, NE  
Washington, DC 20002  
tel 202-380-4000  
fax 202-380-4981  
[www.siriusxm.com](http://www.siriusxm.com)

August 12, 2011

Via Electronic Filing

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street S.W.  
Washington, D.C. 20554

Re: Written *Ex Parte* Presentation  
*Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band*, WT Docket No. 07-293; and  
*Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, IB Docket No. 95-91.

Dear Ms. Dortch:

Sirius XM Radio Inc. ("Sirius XM") writes to respond to recent WCS Coalition *ex parte* presentations urging further relaxation of the same WCS service rules that the Commission modified last year, which would further increase the interference risks to satellite radio's over 35 million listeners.<sup>1</sup> The Commission should not only dismiss the WCS Coalition's requests<sup>2</sup> but also take further actions to ensure that WCS spectrum is used in ways that do not interfere with millions of satellite radio consumers.<sup>3</sup>

Throughout this proceeding, Sirius XM has worked in good faith with the WCS licensees to facilitate the coexistence of satellite radio and adjacent WCS operations. Regardless of the rule revisions the Commission ultimately adopts for the WCS band, Sirius XM will take all necessary steps to diligently protect its services from receiving harmful interference caused by

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<sup>1</sup> See, e.g., Letter from Paul J. Sinderbrand, Counsel to the WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 07-293, IB Docket No. 95-91 (filed June 27, 2011) ("WCS Coalition June 27 Letter").

<sup>2</sup> See Petition of the WCS Coalition for Partial Reconsideration, WT Docket No. 07-293, IB Docket No. 95-91, GEN Docket No. 90-357, RM No. 8610 (filed Sept. 1, 2010) ("WCS Coalition Petition").

<sup>3</sup> See Sirius XM Radio Inc Opposition to Petitions for Reconsideration of the WCS Coalition and AT&T Inc., WT Docket No. 07-293, IB Docket No. 95-91, GEN Docket No. 90-357, RM No. 8610 (filed Oct. 18, 2010) ("Sirius XM Opposition") and Petition for Partial Reconsideration and Clarification of Sirius XM Radio Inc., WT Docket No. 07-293, IB Docket No. 95-91 (filed Sept. 1, 2010) ("Sirius XM Petition"). See also Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, WT Docket No. 07-293, *Report and Order*, Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, IB Docket No. 95-91, *Second Report and Order*, 25 FCC Rcd 11710 (2010) ("2010 WCS Order").

WCS operations. Sirius XM will closely monitor the eventual roll-out of services in the WCS band and the impact these operations have on the continued ability of satellite radio consumers to receive quality service. As directed by the coordination obligations the Commission adopted in the *2010 WCS Order*, Sirius XM will promptly communicate with WCS licensees in the event satellite radio customers experience harmful interference, and it will seek Commission intervention to the extent necessary.<sup>4</sup>

Sirius XM has tried to assess the interference potential of WCS operations by researching many potential WCS deployment options and technologies, including LTE and smart grid uses. With respect to LTE operations, Sirius XM has determined that LTE use of the WCS band under the current rules will present risks of harmful interference similar to those presented by WiMax.<sup>5</sup> Moreover, Sirius XM's further research into smart grid technologies raises concerns that smart grid use of the WCS band has the potential to cause harmful interference to satellite radio operations. One scenario having a particularly high interference risk is where a large number of smart grid base stations would be deployed with low antenna heights close to major roadways. The WCS stations in this case would generate a high power flux density ("PFD") at mobile antenna heights, with significant interference potential to satellite radio.

These findings again demonstrate why the Commission should not modify the WCS rules to accommodate new WCS deployment strategies without first requiring rigorous study of the interference potential of WCS networks operating under the WCS Coalition's latest proposed rule changes. The Coalition has provided no new information justifying any further relaxation of critical technical parameters such as duty cycle, outdoor antenna restrictions, and power density limits – all of which the Commission must carefully consider before it again relaxes rules that

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<sup>4</sup> At minimum, efforts to assess the interference potential of the WCS service require advance notice of any WCS facility deployment, which the Commission recognized both in the WCS rules and its orders granting the original Sirius and XM terrestrial repeater STAs. See 47 C.F.R. § 27.72; Sirius Satellite Radio, Inc., Application for Special Temporary Authority to Operate Satellite Digital Audio Radio Service Complimentary Terrestrial Repeaters, *Order and Authorization*, 16 FCC Rcd. 16773 ¶ 14 (2001) ("we expect WCS licensees to provide ... as much advance notice as possible of when their stations are to be placed in operation"). Given this basic coordination obligation, Sirius XM was surprised at NextWave's recent disclosure that it "has been operating in the WCS band for over a year offering fixed backhaul services." See Letter from Jennifer M. McCarthy, Vice President, Regulatory Affairs, NextWave Wireless Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket Nos. 07-293, 10-112 at 3 (filed Aug. 3, 2011). Not only did Sirius XM never receive notice of these facilities from NextWave, but until recently, Sirius XM found no evidence in the Commission's files that these facilities are operating. Moreover, NextWave apparently attempted to authorize these operations through substantial service filings it submitted after Commission the announced that it would no longer accept such filings. Wireless Telecommunications Bureau Advises 2.3 GHz Wireless Communications Service Licensees That It Will Not Accept Substantial Service Performance Showings, *Public Notice*, WT Docket No. 07-293, 25 FCC Rcd 8230 (2010); see also Letter from Linda C. Chang, Associate Chief, Mobility Division, Wireless Telecommunications Bureau, Federal Communications Commission, to Jennifer L. Richter, Patton Boggs LLP, ULS Application Nos. 0004330038, 0004330039, 0004330040, 0004330042, 0004330043, 0004330045, 0004330046, 0004330047, 0004330048, 0004330049, 0004330051, 0004330052, 0004330056, 0004330067 (June 14, 2011); Petition for Reconsideration of NW Spectrum Co. and WCS Wireless License Subsidiary, LLC, ULS Application Nos. 0004330038, 0004330039, 0004330040, 0004330042, 0004330043, 0004330045, 0004330046, 0004330047, 0004330048, 0004330049, 0004330051, 0004330052, 0004330056, 0004330067, 0004330072, 0004330075, 0004330076, 0004330078, 0004330079, 0004330083, 0004330085, 0004330088, 0004330089, 0004330092, 0004330095, 0004330097, 0004330098, 0004330099, 0004330100, 0004330103 (filed July 13, 2011).

<sup>5</sup> See Technical Appendix.

risk interference to satellite radio. Thorough testing, followed by public comment on that testing, are essential prerequisites to any rule revisions designed to promote LTE deployment in the band or facilitate any other new services such as smart grid operations. Indeed, rather than further loosening the WCS service rules, as discussed below, the Commission should clarify some aspects of its *2010 WCS Order* and reconsider others in order to provide necessary protections to satellite radio's over 35 million listeners.<sup>6</sup>

### WCS Mobile Device Duty Cycle

The WCS Coalition's request that the Commission increase the permissible duty cycle for mobile transmitters operating in LTE systems<sup>7</sup> is disingenuous on two fronts. First, the Coalition claims that certain standards committees need to take action to support the current rules. However, as the attached Technical Appendix illustrates, several different existing LTE operational modes would comply with the essential duty cycle limitations that the Commission adopted to protect satellite radio consumers, while still delivering high uplink data rates sufficient to support popular wireless broadband applications. Second, the Coalition attempts to obfuscate the issue through misdirection – pointing to the unrelated lower peak-to-average power ratio (“PAPR”) of LTE systems in an effort to rationalize increasing the duration of transmissions. A lower PAPR cannot justify an increase in duty cycle for WCS mobile systems. PAPR measures the relationship between the peak power of a transmission and its time-averaged power. While this parameter is relevant to determining the maximum amount of power that might be transmitted in a band at a given moment, it pertains only to in-band power characteristics. Increasing the duty cycle would lengthen the duration of both the WCS in-band emissions and the out-of-band emissions that are present in the satellite radio band while limiting the efficacy of the codeword interleaving upon which satellite radio relies for protection from such impulse noise sources. Thus, the Coalition conflates different potential sources of interference when it argues that a lower PAPR necessarily justifies a higher duty cycle limitation without further testing to demonstrate the operational characteristics of the new system.

The WCS Coalition also reiterates its plea that the Commission eliminate the disparate duty cycle limitations for the frequency division duplex (“FDD”) and time division duplex (“TDD”) variants of LTE systems.<sup>8</sup> However, the testing and data supporting the *2010 WCS Order* were based upon the WCS interests' own assertions that they intended to deploy TDD WiMAX networks.<sup>9</sup> As a result, and “[r]ecognizing that neither the WCS nor SDARS licensees provided analysis or testing of FDD equipment,” the Commission “rel[ied] heavily on the fact that mobile and portable device using FDD technology will have a dedicated band for uplink transmissions rather than sharing a band with base stations' downlink transmissions” in setting its FDD and TDD restrictions.<sup>10</sup> Although AT&T's reconsideration petition argues that LTE

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<sup>6</sup> See Sirius XM Petition.

<sup>7</sup> WCS Coalition June 27 Letter at 2.

<sup>8</sup> *Id.* at 2.

<sup>9</sup> See *2010 WCS Order*, n.92 (“Although the WCS Coalition has indicated that WCS licensees would prefer to implement systems based on TDD technology, we are not prohibiting the implementation of WCS systems based on FDD technology”); *id.*, ¶ 39 (“The WCS Coalition has indicated their preference for TDD”).

<sup>10</sup> *Id.*, ¶ 74.

FDD devices will have less interference potential than TDD devices, neither AT&T nor anyone else has supported this claim by providing test data of FDD WCS devices. The requested rule change could authorize WCS FDD operations with a 100% downlink duty cycle, which would be disastrous for satellite radio. Until there has been full testing based on the proposed rule changes and all parties have had a full opportunity to analyze the results of those tests, the Commission should not raise the duty cycle limit for FDD devices.

#### WCS Mobile and Fixed Device Power Density Limits

The WCS Coalition also restates its opposition to the power density limits that the FCC adopted in the *2010 WCS Order*, but it again offers no evidence demonstrating that the Commission could loosen these protections without creating harmful interference to satellite radio. The only evidence the WCS Coalition cites in support of its request to remove the 50 mW per MHz power spectral density limit on mobile devices is a statement by one of its members that no commercially available equipment is currently designed to operate pursuant to this limit.<sup>11</sup> Moreover, the WCS Coalition's only response to Sirius XM's request for clarification that WCS fixed CPE devices will operate consistent with the limits the Commission adopted for WCS base stations – a 20 W EIRP peak in any 5 MHz with a maximum of 4 W in any 1 MHz of authorized bandwidth – is merely to quote the language from the *2010 WCS Order* where the Commission set this limit.<sup>12</sup>

The commercial unavailability of consumer equipment simply cannot justify adopting a standard likely to create greater interference. The Coalition's anecdotal observations about equipment availability are irrelevant to the importance of power density limits to protect the millions of satellite radio consumers from harmful overload interference, and such observations are even more suspect given the WCS licensees' lack of investment in building facilities or developing solutions to interference concerns. As Sirius XM previously explained, “[a]bsent this protection, WCS transmissions could arguably concentrate the entire 250 mW EIRP of authorized power into a smaller bandwidth near the satellite radio spectrum, thereby significantly increasing the potential for overload interference by up to 6 dB for a 1.25 MHz WiMAX channel.”<sup>13</sup> The WCS Coalition itself has previously proposed a power density limit<sup>14</sup> and purportedly demonstrated at Ashburn that moving the WCS transmit power farther away from the satellite radio band reduces the potential for harmful interference.<sup>15</sup> Yet the Coalition now asks the Commission to eliminate the only rules preventing a WCS licensee from concentrating its transmit power in the spectrum closest to the satellite radio allocation, which would maximize the potential for harmful interference to satellite radio consumers.

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<sup>11</sup> WCS Coalition June 27 Letter at 2-3.

<sup>12</sup> *Id.* at 4.

<sup>13</sup> Sirius XM Opposition at 13.

<sup>14</sup> See Attachment to Letter from Paul J. Sinderbrand, Counsel to the WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission at 14, IB Docket No. 95- 91, WT Docket No. 07-293 (filed Aug. 19, 2009).

<sup>15</sup> See Letter from Paul J. Sinderbrand, Counsel to the WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission at 6, IB Docket No. 95- 91, WT Docket No. 07-293 (filed Aug. 4, 2009).

## Outdoor Antennas

The WCS Coalition is similarly off-base in arguing that Sirius XM has not demonstrated the need to retain the restriction on outdoor antennas for low-powered CPE. As an initial matter, the WCS Coalition misplaces the burden of persuasion; rather than complaining that Sirius XM has not justified the need for the rule, it is incumbent on the WCS Coalition to demonstrate that the outdoor antenna restriction is unnecessary to protect satellite radio consumers – a task it has so far failed to accomplish, or even attempt.

Prior analysis submitted by Sirius XM shows that where an interfering antenna has clear line-of-sight to a satellite radio vehicular receiver – as might be expected with a street-facing outdoor antenna – interference distances can increase two- or three-fold due to decreased path loss as compared to where the path between the antennas is obstructed.<sup>16</sup> The significance of path loss caused by physical obstruction has been long understood in this proceeding; the WCS Coalition's own data indicate that path loss is 3-14 dB greater when a WCS mobile transmitter is brought inside a vehicle, as opposed to under unobstructed conditions.<sup>17</sup> The *2010 WCS Order* relied on expected propagation losses due to the placement of transmitters inside buildings as a primary justification for allowing lower power fixed CPE to operate without a guard band and pursuant to the mobile transmitters' stepped out-of-band emissions mask.<sup>18</sup> While the WCS Coalition is correct to point out that, prior to the 2010 rules, fixed WCS CPE could operate outdoors at any authorized power level over the entire WCS band, it disingenuously ignores that under these same rules, the transmitters would have been subject to an  $80 + 10 \log (P)$  OOB attenuation factor. At minimum, removing the outdoor antenna restriction would necessitate a corresponding increase in OOB interference protection to the levels the rules required before May, 2010.

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<sup>16</sup> Testing conducted by the Southwest Research Institute of outdoor path loss testing between WCS and satellite radio receivers showed path loss between two outdoor antennas at 6 meters of approximately 59-60 dB. When the WCS transmitter is moved inside a vehicle, the path loss at 6 meters was typically at least 6-12 dB greater. Assuming 6 dB additional path loss corresponds with a doubling of the distance, the change from bringing the transmitter outside the vehicle equates to approximately 2-3 times the interference distance. See Letter from Terrence R. Smith and James S. Blitz, Sirius XM Radio, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 07-293, Exhibit 1 at 6-12, Tbls. 3, 4, 5 (filed Feb. 27, 2009).

<sup>17</sup> See Letter from Mary N. O'Connor, Counsel to the WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 07-293, at 5 (filed Aug. 1, 2008).

<sup>18</sup> See 2010 WCS Order, ¶¶ 142-143.

For these reasons, Sirius XM respectfully renews its call that the Commission deny the WCS Coalition Petition to the extent discussed in the Sirius XM Opposition and related filings. Instead, the Commission should strengthen key aspects of its recently-adopted rules to ensure that broadband use of the WCS spectrum provides adequate protection for the established primary satellite radio services in the 2.3 GHz band.<sup>19</sup>

Sincerely,

/s/James S. Blitz

James S. Blitz

Vice President, Regulatory Counsel

Sirius XM Radio Inc.

1500 Eckington Place, N.E.

Washington, D.C. 20002

Terrence R. Smith

Corporate Vice President and

Chief Engineering Officer

Sirius XM Radio Inc.

1221 Avenue of the Americas

New York, NY 10020

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<sup>19</sup> See Sirius XM Petition.

## **TECHNICAL APPENDIX**

Sirius XM has reviewed the frame structure of LTE technology to determine whether operational modes can be programmed to comply with the Commission's duty cycle limitations for WCS transmissions. As shown below, Sirius XM has identified multiple operational modes that would be compliant with the rules while still providing uplink data rates ranging between 800 and 2,600 kilobits/second.

LTE frame length is 10 milliseconds (ms). Each frame contains 10 sub-frames of 1 ms length. Each sub-frame can be used either as a base station downlink transmission sub-frame, a special sub-frame, or a user terminal downlink sub-frame. The special sub-frame always follows the downlink transmissions, and is 1 ms long in the seven available LTE configurations. The special sub-frame always starts with a Downlink Pilot Time Slot (DwPTS) field, which is followed by a Guard Period (GP) field. The special sub-frame always ends with an Uplink Pilot Time Slot (UpPTS) field, which can vary from 71 micro seconds ( $\mu$ s) to 166  $\mu$ s, if it is transmitted. For those LTE configurations where the special sub-frame is repeated twice, the length of UpPTS could be up to 333  $\mu$ s (or 0.333 ms). Assuming that four sub-frames are used for uplinking information from a user terminal, and two longest UpPTS fields are also used, then the total uplink transmission time can be up to 4.333 ms (4 + 0.333 ms). This is roughly equal to 44% duty cycle of a 10ms frame.

LTE supports seven different downlink and uplink signal transmission configurations as illustrated in the below table.<sup>1</sup> Note that each downlink (D) and uplink (U) sub-frame is 1ms long.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Table 1: LTE uplink and downlink configurations

In these configurations, configuration #0 would allow uplink transmission of six uplink sub-frames and two special fields that could yield uplink transmissions from a user terminal up to 6.333 ms, or roughly 64% duty cycle over a 10ms frame. Running a similar calculation for all configurations, one can list the supportable maximum uplink duty cycles for all seven LTE configurations in the following manner.

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<sup>1</sup> See Samsung Electronics, "LTE PHY Spec." (June 24, 2008) available at <http://www.slideshare.net/allabout4g/lte-rel-8-physical-layer>.

#0 could allow 4.333 ms, or 64%  
 #1 could allow 4.333 ms, or 44%  
 #2 could allow 2.333 ms, or 24%  
 #3 could allow 3.166 ms, or 32%  
 #4 could allow 2.166 ms, or 22%  
 #5 could allow 1.166 ms, or 12%  
 #6 could allow 5.333 ms, or 54%

Available LTE configurations 2, 3, 4 and 5 will properly restrict the uplink transmissions within the duty cycle limits allowed by the Commission, 38% for the terminals using the TDD technology. However, the uplink scheduler can be conditioned to only allow uplink transmissions up to 38% duty cycle even when using the other available LTE configurations 0, 1 and 6. As a result, it can easily be seen that four out of the seven available LTE configurations can support the existing Commission's uplink duty cycle limits while the other three can support it with proper uplink settings on the scheduler.

The following table shows peak data rates for a 5 MHz channel configuration. In this table, 16 QAM modulation is used for the uplink, and 64 QAM modulation is used for the downlink.

Configuration	5MHz TDD Peak Rates		
	Downlink MIMO 2	Uplink 2 Rx Div	Aggregate
<b>#0 64%</b>	<b>10.6</b>	<b>5.3</b>	<b>15.9</b>
<b>#1 44%</b>	<b>16.9</b>	<b>3.5</b>	<b>20.4</b>
<b>#2 24%</b>	<b>23.2</b>	<b>1.7</b>	<b>24.9</b>
<b>#3 32%</b>	<b>21.0</b>	<b>2.6</b>	<b>23.6</b>
<b>#4 22%</b>	<b>24.1</b>	<b>1.7</b>	<b>25.8</b>
<b>#5 12%</b>	<b>27.3</b>	<b>0.8</b>	<b>28.1</b>
<b>#6 54%</b>	<b>13.7</b>	<b>4.4</b>	<b>18.1</b>

This analysis demonstrates that even LTE profiles 2 through 5, which satisfy the 38% duty cycle limitation the Commission has adopted, provide relatively high uplink capacity supporting data rates up to 2.6 Mbps. However, WCS Coalition has repeatedly said that broadband wireless services in this band will be downlink intensive, thereby making all configurations plausible, including those having the lowest uplink capacity.